Irrigation," by F. C. Danvers. An account of the advantages that would result to agriculture from a system of irrigation, rendered necessary by the destruction of forests, irrespective of the question of the utilisation of sewage. 4. "War Science," by H. Baden Pritchard. A statement of the instruction in War Science given in the Royal Artillery and Royal Engineers, and of recent improvements in gunnery, illustrated especially by the Scott and Moncreiff gun-carriages; the improved modes of manufacturing gunpowder; and the invention of the electric torpedo in conjunction with the Abel fuse. 5. "Spectra of Metallic Compounds," from the Journal of the Franklin Institute. 6. "On the various Tints of Autumnal Foliage," by H. C. Sorby. A very interesting paper, in which the writer details the results of his experiments on the various colouring matters of leaves, &c., which he classifies as follows:—(1) *chlorophyll*, or the green colouring matter; very rarely found pure, even in fresh leaves; insoluble in water, but soluble in alcohol or bisulphide of carbon; the spectra have all a very well-marked absorption band in the red, but the green is more or less completely transmitted, so that the prevailing tint is a more or less modified green; (2) the *xanthophyll*, or yellow group; insoluble in water, but soluble in alcohol and in bisulphide of carbon; the spectra show absorption at the blue end, often with more or less well-marked narrow bands; but the red, yellow, and yellow-green are freely transmitted, so that the general colour is clear yellow or orange; (3) *erythrophyll*, or the red colouring matter; soluble in water and aqueous alcohol, but not in bisulphide of carbon; show strong absorption in the green part of the spectrum; (4) *chrysophyll*, or the golden-yellow group; soluble in water and aqueous alcohol, but insoluble in bisulphide of carbon, with variable spectra; (5) the *phaiophyll* group, comprising various browns; soluble in water, but not in bisulphide of carbon; do not give well-defined absorption-bands. Mr. Sorby gives the following scheme of the relative abundance of these various groups of colours as the leaves advance towards decay.

| | | |
|---|---|---|
| Complete vitality and growth . . | Chrysophyll . . | More or less bright green. |
| | Chlorophyll . . | More or less green-brown. |
| Low vitality and change . . . | Erythrophyll . . | More or less red-scarlet. |
| | Xanthophyll . . | More or less bright orange-brown. |
| Death and decomposition . . | Phaiophyll . . | Less or more dull brown. |
| | Humus . . . . . | |

7. "On the Relations between Chemical Change, Heat, and Force, with a special view to the economy of electro-dynamic engines," by the Rev. H. Highton. Contests the theory generally accepted that a certain amount of chemical change corresponds and is interchangeable with a certain amount of heat and electric force; and that this heat again corresponds and is interchangeable with a certain amount of work or mechanical energy. The author considers that the whole subject requires a fresh, strict, and full experimental investigation. He then refers to the many different answers that have been given to the question, What is the mechanical equivalent of heat? and holds that it has never been proved that there is any such equivalent. He details in support of his view the conflicting results obtained from the elaborate experiments with a galvanic battery by such experimenters as M. Favre, M. Sorel, M. Weber, M. Kohlrausch, and Mr. Gore. 8. "Our Patent Laws."—The pages devoted to "Progress of the Sciences" again embrace Physical Science only, Physics, Chemistry, and Mechanics—an inequality which will doubtless be rectified in future numbers.

## *SOCIETIES AND ACADEMIES*

### LONDON

**Royal Society,** January 12.—"Some Experiments on the Discharge of Electricity through Rarefied Media and the Atmosphere." By C. F. Varley.—After the labours of Mr. Gassiot, one approaches this subject with diffidence, lest he should appear to be attempting to appropriate the glory which so justly belongs to that gentleman and to Professor Grove. The nature of the action inside the tube is at present involved in considerably mystery, but some light is thrown upon the subject by the following experiments. Before describing them, however, the author wishes to observe that he has seen Mr. Gassiot's last papers,* and finds that, so far as regulating the strength of the current is concerned, he has been proceeding in a similar manner to the author. The tube principally used in these experiments contains two aluminium wire rings, the one $\frac{4}{10}$ inch in diameter, the other $\frac{9}{10}$, and separated $\frac{8}{10}$ inch, the tube 1¼ inch in diameter, 3¼ inches in length; it was one of Geissler's manufacture, was very well exhausted, and professed to contain hydrogen. A U-shaped glass tube containing glycerine and water was placed in circuit. Two aluminium wires inserted in this tube gave a ready means of reducing or augmenting the resistance at pleasure. Glycerine affords an easy means of producing very great resistances. The battery used in this experiment was a Daniell's battery, each cell having a resistance of from 50 to 100 Ohms. The resistance of the glycerine-and-water-tube was between 2 and 3 megohms; this latter resistance was made large, in order that the resistance of the tube and battery might be neglected without entailing error. The following law was found to govern the passage of the current:—1st. Each tube requires a certain potential to leap across. 2nd. That having once established a passage for the current, a lower potential is sufficient to continue the current. 3rd. If the minimum potential, which will maintain a current through the tube, be P, and the power be varied to $P+1$, $P+2$, &c. to $P+n$, the current will vary in strength, as 1, 2, &c. $n$. The following Tables (I. and II.) illustrate this; there is a little irregularity in the figures due to the irregularity of the battery, although it was recharged for the occasion.

TABLE I.

| 1. | 2. | | | | 3. | 4. |
|---|---|---|---|---|---|---|
| Cells of Daniell's Battery, $P+n$. | Observed Deflections of Reflecting Galvanometer. | | | | Mean. | 3rd Col. divided by $n$. |
| 307 = P + 3 | 0 | 0 | 0 | 0 | 0 | 0 |
| 308 = P + 4 | 5 | 5½ | 5 | 5½ | 5¼ | 1·3 |
| 309 = P + 5 | 9 | 9 | 9 | 9 | 9 | 1·8 |
| 310 = P + 6 | 12 | 12½ | 12 | 12½ | 12¼ | 2·04 |
| 311 = P + 7 | 14 | 14 | .. | .. | 14 | 2 |
| 312 = P + 8 | 16 | .. | .. | .. | 16 | 2 |
| 313 = P + 9 | 17½ | 18 | 18 | .. | 17¾ | 1·97 |
| 314 = P + 10 | 19½ | 19½ | .. | .. | 19½ | 1·95 |
| 315 = P + 11 | 21½ | 21 | 22 | 21½ | 21½ | 1·95 |
| 316 = P + 12 | 23½ | 23½ | 23½ | .. | 23½ | 1·96 |
| 317 = P + 13 | 25½ | .. | .. | .. | 25½ | 1·96 |
| 318 = P + 14 | 27½ | .. | .. | .. | 27½ | 1·97 |
| 319 = P + 15 | 29½ | .. | .. | .. | 29½ | 1·97 |
| 320 = P + 16 | 31½ | 31½ | 31 | 31 | 31¼ | 1·95 |
| *323 = P + 19 | 37½ | 38 | 37 | 37½ | 37½ | 1·97 |
| 325 = P + 21 | 40¾ | 41 | 40½ | .. | 41¾ | 1·94 |
| 330 = P + 26 | 51 | 51 | .. | .. | 51 | 1·96 |
| 335 = P + 31 | 60½ | 60½ | .. | .. | 60½ | 1·95 |
| 340 = P + 36 | 70 | 70 | .. | .. | 70 | 1·94 |
| 345 = P + 41 | 79½ | 79½ | .. | .. | 79½ | 1·94 |
| 350 = P + 46 | 89 | 89 | .. | .. | 89 | 1·94 |
| 355 = P + 51 | 98½ | 98½ | .. | .. | 98½ | 1·93 |
| 360 = P + 56 | 108 | 108 | .. | .. | 108 | 1·93 |
| 365 = P + 61 | 118 | 118 | .. | .. | 118 | 1·94 |
| 370 = P + 66 | 128 | 128 | .. | .. | 128 | 1·94 |
| 375 = P + 71 | 139 | 140 | .. | .. | 139½ | 1·96 |
| 380 = P + 76 | 150 | 150 | .. | .. | 150 | 1·97 |

TABLE II.

| | | | | | | |
|---|---|---|---|---|---|---|
| 304 = P + 0 | 0 | .. | .. | .. | 0 | 0 |
| 305 = P + 1 | 2 | 2 | .. | .. | 2 | 2 |
| 306 = P + 2 | 4 | 4 | .. | .. | 4 | 2 |
| 307 = P + 3 | 6 | 6 | .. | .. | 6 | 2 |
| 308 = P + 4 | 8 | 8 | .. | .. | 8 | 2 |
| 309 = P + 5 | 10 | 10 | .. | .. | 10 | 2 |
| 310 = P + 6 | 12 | 12 | .. | .. | 12 | 2 |
| 320 = P + 16 | 31½ | 32 | .. | .. | 31¾ | 1·97 |
| 330 = P + 26 | 51 | 51 | .. | .. | 51 | 1·96 |
| 340 = P + 36 | 71 | 71½ | .. | .. | 71 | 1·97 |

It thus appears that a certain amount of power is necessary to spring across the vacuum; after that it behaves as an ordinary conductor, excluding that portion of the battery whose potential is P, and which is used to balance the opposition of the tube. In these experiments P was 304 cells. The tube in question could not be persuaded to allow a current of less than 323 cells to pass; but when once the current had established a channel, on lowering the potential by *short circuiting* portions of the battery, so as not to break the circuit, the current would flow when the battery was reduced to 308 cells. By, however, passing a current from 600 cells through the second tube W, filled with pure glycerine, and offering several thousand megohms resistance, an extremely feeble current, too weak to affect the galvanometer, kept a channel open by its passage; with this arrangement the figures in Table II. were obtained, which are more regular at the commencement, and a power of $P+1$ would pass across the tube. The positive pole alone was observed to be luminous when the current was very minute, and the negative only was luminous when the current was strong. The following experiments were tried, and the results, which have been photographed, accompany the paper. A current was passed through the tube U and the vacuum; the U tube contained pure glycerine, and had a very large resistance, which was gradually reduced. At the commencement it was more than 10,000 megohms; the upper or small ring was positive, the lower ring was negative. The power was so reduced that the faintest possible light only was visible; in this case the positive wire alone was luminous, whether it were the large or small ring that was positive. The light was so feeble that, though the experiment was conducted in a perfectly dark room, we were sometimes unaware whether the current was passing or not. An exposure of thirty minutes' duration left, as will be seen, a very good photographic record of what was taking place; this means of viewing light too feeble for the eye may receive other applications. The resistance was then reduced, when the light became much more brilliant,—a tongue of light projected from the positive pole towards the negative, the latter being still almost completely obscure. The light around the positive pole was to all of our eyes white, while the projecting flame was a bright brick-red. This bright brick-red, however, possessed great photographic power. The negative wire at this stage began to show signs of luminosity. As the power was increased, the flame became detached from the positive pole. On still further increasing the power, the positive pole ceased to be luminous; and on still further increasing the power, by removing the U tube altogether, the light surrounded the negative wire, the photograph shows a white flattened hour-glass, apparently detached from the wire; to the eye, however, the wire appeared to be surrounded by a bright blue envelope $\frac{1}{4}$ inch in diameter, which did not possess sufficient photographic power to leave a record of itself, while the red portion did so. A large condenser was now attached to the battery, and discharged through the tube (the condenser had a capacity of 27 microfarads); this was equivalent to a momentary contact with a battery of little or no resistance. The flash was exceedingly brilliant to the eye; it could be heard outside the tube with a sharp click; the eye, however, was so dazzled as not to be able to see its shape. The light was confined entirely to the *positive pole*; thus, then, as the power is increased from nothing upwards, the first pole to become luminous is the positive; secondly, the two poles become luminous; thirdly, the negative pole alone is luminous; and fourthly, with an instantaneous discharge, the positive pole only is luminous. When the resistance in the U tube was greatly reduced, and a galvanometer (not very sensitive) was inserted, so that the chief resistance in circuit was that of the exhausted tube, as the potential was augmented cell by cell, the changes took place abruptly and suddenly. For example, when the power was so low that the positive pole only was visible, the current was feeble, and kept augmenting in power as cell after cell was added on. Suddenly the luminous red flame made its appearance, and the galvanometer showed that the current had suddenly augmented three or four times in power. As the power was again further increased, cell by cell, the current again steadily augmented in proportion, until the luminous tongue suddenly disappeared, the galvanometer showing a still further sudden increase in the current.

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* Proc. Roy. Soc., vol. xi. p. 329, & vol. xii. p. 329.

* This power, 323, was the lowest at which the current would jump.

*Nature of the luminous cloud.*—Plücker has shown that when such an exhausted tube, with a current through it, is placed between the poles of an electro-magnet, a luminous arch is produced, which arch follows the course of the magnetic rays. As the electro-magnet is magnetized, the tube, which before was full of a luminous cloud, is seen gradually to change; the magnet gathers up this diffused cloud, and builds up an arch. Inasmuch as the electricity was passing in a continuous current from the battery, from wire to wire, it is evident the light is projected right and left into those parts of the tube where there is no electric current flowing. To endeavour to ascertain the nature of this arch, a tube was constructed. A piece of talc, bent into the form U, had a fibre of silk stretched across it; on this fibre of silk was cemented a thin strip of talc, 1 inch in length, $\frac{1}{10}$ inch broad, weighing about $\frac{1}{10}$ of a grain. The tube was sealed up and exhausted; carbonic acid and potash were used to get a high vacuum. When the magnet was not magnetized, the passage of the current from wire to wire did not affect the piece of talc. When the magnet was charged, and the luminous arch was made to play upon the lower portion of the talc, it repelled it, no matter which way the electric current was passing. When the tube was shifted over the poles of the magnet so as to project the luminous arch against the upper part of the talc, the upper end of the talc was repelled in all instances; the arch, when projected against the lower part of the talc, being near the magnet, was more concentrated, and the angle of deviation of the talc was as much as 20°. When the upper part of the arch, which was much more diffused, was thrown upon the upper part of the talc, it was repelled about 5°. This experiment, I think, indicates that this arch is composed of *attenuated particles of matter projected* from the negative pole by electricity in all directions, but that the magnet controls their course, and these particles seem to be thrown by momentum on each side of the negative pole, beyond the limit of the electric current. This arch requires time for its formation, for when a charged condenser is discharged through the tube no arch is produced. The arch from the negative pole is a hollow cylinder; the little talc tell-tale against which the arch was projected cut out the light, and a corresponding dark space existed throughout the remainder of the course of the arch. There was on the talc, at the spot where the arch struck it, a little bright luminous cloud, as though the attenuated luminous vapour was condensed by this material obstruction. Great care had been taken not to let the arch strike the single filament of silk which suspended the talc. Having demonstrated that the talc was repelled as described, the arch was allowed to play against the silk fibre, which the author expected would have been instantly burnt; such, however, was not the case. Even when a powerful induction-coil replaced the battery, the fibre remained unhurt.

*Comparison of the above phenomena with discharges between the poles of a Holtz's Machine in air.*—In the first part of this paper four different kinds of discharges were described *in vacuo*. With a "Holtz's" machine, which will give 11-inch sparks in the air, four well-marked different kinds of discharge have been obtained *in the air*; one of which, the author thinks, will explain the curious and rare phenomenon known as "ball lightning." In the experiments hereafter referred to, the condensers were in all cases attached to the "Holtz's" machine. The first discharge is the long 11-inch zigzag spark or lightning-flash; the second is the well-known "brush," which is best obtained by connecting the negative pole of the "Holtz's" machine to the earth; the third kind of discharge is a hissing red flame, $\frac{1}{2}$ inch in length, playing about the negative pole, the positive pole being scarcely luminous at all, and if luminous, at one or two points only; the fourth or most remarkable phenomenon is best obtained in the following manner (I should here remark that the brass balls on each of the poles are about an inch in diameter):—Tie to the negative pole a small thin strip or filament of wood three inches in length, and bent so as to project on each side of the negative pole, and a little beyond it towards the positive. On rotating the machine, two bright spots are seen upon the positive pole. If the positive pole be made to rotate upon its axis, the luminous spots do not rotate with it; if, however, the *negative pole*, with its filament of wood, be rotated, the spots on the *positive pole obey it*, and rotate also. The insertion of a non-conductor, such as a strip of glass, in front of the projecting wooden end, obliterates the luminous spot on the positive pole. When the author first discovered this, he, seeing apparently pieces of dirt on the positive pole, wiped it clean with a silk handkerchief, but there they remained in spite of all wiping; he then examined the negative pole, and discovered a minute speck of dirt corresponding to the luminous spots on the positive pole. When the filament of wood is removed from the negative pole there is sometimes a luminosity or glow over a large portion of the surface of the positive ball. If in this state three or four little pieces of wax, or even a drop or two of water, be placed upon the negative pole, corresponding non-luminous spots will be found upon the positive pole, which rotate with the former, but do not with the latter. It is therefore evident that there are lines of force existing between the two poles, and by these means one is able to telegraph *from* the negative *to* the positive pole to a distance of 8 inches through the air, without any other conductor than that which the electrical machine has constructed for itself across the non-conducting gas. The foregoing seems to the author to give a possible explanation of "ball-lightning;" if it be possible for there to be a negatively electrified cloud sufficiently charged to produce a flash from the earth to the cloud, a point in the cloud would correspond to the wood projection on the negative conductor; if such a cloud exist, a luminous spot would be seen moving about the surface of the earth, corresponding to the moving point of cloud over it, and thus present phenomena similar to those described by the privileged few who have witnessed this extraordinary natural phenomenon. The following experiment shows that, prior to the passage of the electric spark, a channel is prepared for this spark to pass. The positive and negative balls of the machine were separated to a distance of 6 or 7 inches, and a common candle-flame was placed midway between them. On rotating the machine, the flame was drawn out on each side just prior to the passage of the spark. Sometimes it extended to a width of 5 or 6 inches; this took place every time the spark passed. It is well known that the duration of this spark is less than the $\frac{1}{1000000}$ part of a second; the flame occupied the $\frac{1}{8}$ or $\frac{1}{10}$ part of a second in flying out to make the conducting channel through which the discharge went. The author has been informed more than once by captains of vessels, that when men have been struck by lightning a burn has been left upon the skin of the same shape as the object from which the discharge flew. In one instance he was informed that some brass numbers, attached to the rigging from which the discharge passed to the sailor, were imprinted upon his skin. It is now seen that this is perfectly possible if the discharge be a negative one, that is, if the man be + to the brass number.

**Ethnological Society**, January 10.—Prof. Huxley, President, in the chair.—Mr. Francis Hewitt was announced as a new member.—A collection of stone implements from Queen Charlotte and Vancouver Islands was exhibited by Dr. Hooker, C.B., and some artificially distorted skulls from Vancouver Island were exhibited by Col. A. Lane Fox.—A paper was read, "On the Prehistoric Monuments in Brittany," by Lieut. S. P. Oliver, R.A., illustrated by a large collection of drawings and plans. The author first described the alignments at Carnac, which are arranged in three distinct groups—those of Menec, Kervario, and Kerlescant. At Menec there are eleven lines of stones with a circle at the south-west; at Kervario there are ten convergent lines; and at Kerlescant thirteen lines, with an enclosure of horse-shoe form. The stone avenues of Erdeven, St. Barbe, St. Pierre, and Plouhinec, were also noticed among the antiquities of the Morbihan; and attention was then directed to the alignment of Crozon, in the neighbouring Department of Finisterre. From the rude character of the stones in all these avenues and circles as compared with those in the neighbouring dolmens and menhirs, the author believes that the megalithic remains are of two distinct classes, differing considerably in date, the alignments and circles of amorpholiths being referable to a much earlier race than the dolmen-builders. Many of the tumuli of Brittany were then described, and attention directed to the archaic sculpturing upon some of the stones, and to the celts which have been found within the tumuli. Of these celts a large proportion are formed of the rare mineral *fibrolite*. The discussion upon this paper was sustained by Sir H. Dryden, Capt. Godwin-Austen, the Rev. H. Winwood, and Messrs. A. W. Franks, Hyde Clark, and Edgar Layard.—Some notes were read on a Cairn near Cefn, St. Asaph, by the Rev. D. R. Thomas, M.A., and T. McK. Hughes, M.A. The authors described two chambered tombs within the area of a large cairn which had long been removed. One of these cists was brought to light by excavations, which were undertaken in consequence of a visit to the spot by a party from the British Association after the Liverpool meeting.

## NORWICH

**Norfolk and Norwich Naturalists' Society**, December 20.—A box of very beautiful and rare fen moths, presented by the Hon. T. de Grey to the Museum, was exhibited.—Mr. Stevenson read a paper on "The Abundance of Little Gulls on the Norfolk Coast in the Winter of 1869-70." This bird has hitherto been considered an occasional straggler on the Norfolk coast, but during the month of February last an unprecedented number appeared. It is probable that over sixty specimens were killed in this county; of these the great majority were adult males. These birds have recently been discovered to breed in considerable numbers in Lake Ladoga, further to the north and west of which it is not at present known to breed. Mr. Stevenson presumes that the stragglers, mostly young birds, which in autumn and winter appear on the coast of Great Britain, form part of that colony, which, migrating in a westerly rather than in a southerly direction, pass from the Baltic into the North Sea. The adult birds rarely approach the shore, but, from the sudden and irresistible force of the gale which visited us in February last, they were, doubtless, compelled to seek the shelter of our bays and estuaries.—Mr. Barrett stated that, since he read his paper on "The Coast Insects found near Brandon," at the last meeting, he had received some valuable evidence confirmatory of the views he then expressed. The Hon. T. de Grey informed him that he had taken *Agrestes cinerea* and *Gelechia vitella*, both of them rare sandhill insects, at Brandon, and *Gelechia marmorea* as far away as Tottington, on the Merton estate. Other species had been taken by the Rev. H. S. Mariott, of Wickham Market, and the Rev. H. Williams, of Croxton.—Mr. Geldart stated that *Phleum arenarium*, an essentially sea-side grass, was to be found growing on the sandy warrens about Brandon.

## DUBLIN

**Royal Geological Society**, January 11.—"On the Geological age of the Ballycastle Coal-field, and its relation to the carboniferous rocks of the West of Scotland, by Mr. E. Hull, F.R.S." The object of the paper was to prove that the coal-field of Ballycastle, Co. Antrim, was referable to the type of the lower coal-field of Scotland, and consequently of the age of the Lower Carboniferous series; in other words, of the mountain limestone. The Carboniferous series of Ballycastle which had been described in 1829 by Sir R. Griffith, F.R.S.,* was shown to consist of three divisions in descending order. 1. *The Upper*, consisting of massive sandstones, and shales with beds of coal, black band and clay band ironstones, &c. (*Lingula squamiformis*). 2. *The Middle*, consisting of a thin bed of limestone lying between shales with carboniferous limestone genera and species of shells, crinoids, and corals. 3. *The Lower*, consisting of massive reddish grits, and conglomerate with thin beds of shale. The author showed that the carboniferous limestone of Ireland undergoes, in its extension northward, changes similar to those of the same formation in Britain, when traced from Derbyshire into Northumberland and Scotland. The calcareous element thins away, and is replaced by sedimentary strata of sandstone, shale, &c., with approximately terrestrial conditions, productive of coal and ironstone. It was thus that in the case of the Glasgow coal-field, the limestone of Derbyshire, several thousand feet in thickness, was represented by only thin bands of earthy limestone, interstratified with a thick series of grits, shales, &c., with ironstone and coal. In a similar manner the Ballycastle coal-field, with only a few feet of limestone, shown in the cliffs of the bay, was the representative of the carboniferous limestone of the centre of Ireland, nearly 3,000 feet in thickness. Mr. Hull regarded the lower division (No. 3) of the Ballycastle beds (as above described) as undoubtedly the representative of the "calciferous sandstone series" of the Geological Survey, which lies at the base of the carboniferous rock of the West of Scotland, and that the middle and upper division (Nos. 2 and 1) corresponds to the carboniferous limestone series, or lower coal-field of that country. As regards the palæontological evidence, it was in favour of this view, as far as it had been studied. Out of thirty-three species observed in the limestone band of Ballycastle Bay, 50 per cent. had been described in the Lower Carboniferous rocks of the West of Scotland,† and one of the uppermost seams of coal, lying above the limestone, had yielded *Lingula squamiformis*, a form characteristic of the limestone series in the North of England, Scotland, and Ireland. Mr. W. H. Baily, F.G.S., concurred in the view of the age of these beds on palæontological grounds. The author concluded by pointing out several features of similarity between the Ballycastle beds and the lower coal series of the West of Scotland, such as the occurrence of several beds of "black band" ironstone; the hydraulic and earthy character of the limestone of Ballycastle Bay, exactly resembling the "Arden" and "Cowglen" bands of Glasgow. Some uncertainty still remained whether there were any beds in the Ballycastle district as high in the Geological Series as the millstone grit, a true coal measure, but until more light could be brought to bear on this question by further exploration, and a complete investigation by Government surveyors, the author meanwhile regarded the whole series as Lower Carboniferous.

## MONTREAL

**Natural History Society**, Nov. 28.—Dr. Dawson, president, in the chair. A paper was read upon the Canadian phosphates of lime in their application to agriculture, by Mr. Gordon Broome, F.G.S., calling special attention to the valuable apatite deposits of the Rideau district. The author gave a large amount of valuable information upon the manufacture of "superphosphates," noticing the good work being done at Brockville in this particular branch of industry, and proving that large areas of land now wholly or partially exhausted, in various portions of Lower Canada, might still have been yielding large returns of wheat and other cereals, had they been farmed upon a rational system of agriculture, coupled with the judicious employment of phosphatic and other fertilisers. We quote from the concluding words of this comprehensive essay: "He made especial reference to the comparative dormant state of this, and other equally obvious sources of industry in Canada, arising from a great deficiency in a most important division of our national education, and that nothing save a liberal augmentation of the ordinary courses of instruction in modern subjects can ever dispel the immense existing clouds of ignorance and prejudice. It is, therefore, sincerely to be hoped that the very able remarks recently made by Principal Dawson upon this question may have their desired effect, and that Canada may speedily obtain a share in the improvements that have of late almost revolutionised the systems of educations in the universities of the mother country." Dr. Hunt, Vice-President of the Association, then referred in a feeling manner to the loss sustained by science in Canada, in the death of Mr. Hartley, of the Geological Survey, who, though only twenty-three years of age, was one of the most promising young men in the country.

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* Report on the Coal Districts of Tyrone and Antrim, addressed to the Royal Dublin Society, 1829.

† Trans. Geol. Soc., Glasgow.

### Vienna

**I. R. Geological Institute**, December 20.—M. Fr. v. Hauer stated that the Institute had happily come into possession of the only known specimen of Psephophorus polygonus from Neudörfl in Lower Austria, which had been described after a drawing more than twenty years old by Herm. von Meyer, and had been designated by him one of the most interesting fossil remains of a vertebrate animal ever found in Austria. It consists of a plate of epidermal scales nearly two hundred in number, and perfectly irregular in size and form. H. v. Meyer thought it to belong to an animal of the family of the Dasypodidæ, whilst Prof. Müller compared an analogous plate found in the Zeuglodon beds of North America with the plate of Dermatochelys.—M. F. v. Vivenot read a memoir on the microscopical examination of the syenite of Blansko in Moravia, in which, besides the minerals which are distinguishable with the naked eye, as oligoclase, quartz, amphibole, biotite, titanite, and magnetite, he discovered also orthoclase, epidote, and apatite.—M. E. Tietze exhibited specimens of cornubianite from Servia, which perfectly resembled the cornubianite of Cornwall, and like it were found in a stratum interposed between granite and argillaceous schist.—M. Posepny communicated his observations on the beds of rock-salt in Transylvania.

## BOOKS RECEIVED

English.—The Transformations (or Metamorphoses) of Insects: P. M. Duncan (Cassell and Co.)—Wonders of the Human Body: A. Le Pileur (Blackie and Son).—Dogs and their Doings: Rev. F. O. Morris (Partridge and Co.).—The Genesis of Species: St. George Mivart (Macmillan and Co.).—Matheran Hill: its People, Plants, and Animals: Dr. J. Y. Smith (Maclachlan and Stewart).

Foreign.—Vorschule der Experimentale Physik: H. F. Weinhold (D. Nutt).

## PAMPHLETS RECEIVED

Prospectus of Sir Joseph Whitworth's Scholarships for Mechanical Science, 5th ed.—A Letter to the Duke of Argyll on the Proposed Scheme for an Engineering College: Dr. F. T. Bond.—On Equal-surface Projection and its Anthropological Applications: C. Piazzi Smyth.—On the Cellular Structure of the Red Blood-corpuscle: Dr. J. G. Richardson (Philadelphia).—Report on the Canadian Phosphates: G. Broome, pt. 1.—Eloge de Jean-Theodore Lacordaire: par E. Morren.—Das Differentialphotometer u. eine neue Thermosäule: Prof. K. W. Zenger.—Chemische Notizen: Prof. F. Stolba.—Ueber Das Kieselfluorammonium u. Kieselfluornickel: Prof. F. Stolba.—Ueber Erzeugung algebräischer Curven durch mehrdeutige Elementargebilde: Dr. E. Weyr.—Studien zur Theorie der Covarienten u. Invarienten der binären Formen: Dr. J. Dienger.—Ueber den Zusammensetzen verschiedener Transformationsformeln für elliptische Integrale: Prof. J. Lieblein.—Ueber fortgesetztes Tangentenziehen au Curven dritter Ordnung: Dr. H. Durége.—Beobachtungen üeber einige fossile Pflanzen aus dem Steinkohlenbecken von Radnic: C. Feistmantel.—Beobachtungen über die Entstehung einiger sphäroidischer Gebilde im Mineralreiche: C. Feistmantel.—Die Porphyre im Silurgebirge von Mittelböhmen: C. Feistmantel.—Die Steinkohlengebilde in der Umgebung von Radnitz in Böhmen: C. Feistmantel.—Beiträge zur Lehre der universellen Summirung von Strecken: Dr. W. Martzka.—Die Sätze von Bürmann u. Lagrange: Dr. J. Dienger.—Ueber die Normalenfläche zum dreiaxigen Ellipsoide: J. M. Sölin.—Ueber die Callianassen der böhmischen Kreideformation: Dr. A. Fritsch.—Ueber die physikalischen Constanten des Wasserdampfes: Prof G. Schmidt.—Ueber die neueren physiologisch-psychologischen Forschungen im Gebiete der menschlichen Sinne: Dr. J. Dastich.—Auflösung der Gleichungen des $2^{ten}$, $3^{ten}$, u. $4^{ten}$ Grades: J. Machometz.—Beiträge zur Weddle's Methode der Auflösung numerischer Gleichungen: J. Popper.—Beiträge zur Auflösung höherer Gleichungen: Dr. J. P. Kulik.—Ueber das Bourdonsche Metallbarometer: Dr V. Pierre.—Ueber das Binocularsehen: Dr. J. Ritter von Hasner.—Die Methode der orthonogalen Projekzion auf zwei Ebenen: Prof. R. Skuhersky.—Parallèle entre les dépôts Siluriens de Bohème et de Scandinavie.—Resultate mehrjähriger Beobachtungen über jene Pflanzen deren Blumenkronen sich täglich periodisch öffnen u. schliessen: K. Fritsch.—Grundzüge einer Meteorologie für den Horizont von Prag: K. Fritsch.

## DIARY

### *THURSDAY*, January 19.

Royal Society, at 8.30.—On the Structure and Development of the Skull of the Common Frog: W. K. Parker, F.R.S.—Method of Measuring the Resistance of a Conductor: H. Mance.—Modification of Wheatstone's Bridge to determine the Resistance of a Galvanometer Coil from a single Deflection of its own Needle: Sir W. Thomson, F.R S.

Society of Antiquaries, at 8.30.—The Pre-Christian Cross; H. M. Westropp.

Linnean Society, at 8.—On the Vegetation of the Solomon Islands: Mr. Atkin.—Note on Byrsanthus (*Homalineæ*): Dr. M. T. Masters, F.R.S., F.L.S.—Historical Notes on the *Radix Galanga* of Pharmacy: Daniel Hanbury, F.R.S., F.L.S.

Chemical Society, at 8.

Royal Institution, at 3.—Davy's Discoveries: Dr. Odling.

### *FRIDAY*, January 20.

Royal Institution, at 9.—Dr. Tyndall.

### *SATURDAY*, January 21.

Royal Institution, at 3.—Laws of Life revealed in History: Rev. W. H. Channing.

Association of Officers of Health, at 8.—On Parasites, in relation to the Sewage Irrigation Question: Dr. Cobbold.

### *SUNDAY*, January 22.

Sunday Lecture Society, at 3.30.—How Coal and the Strata in which it is found have formed: A. H. Green.

### *MONDAY*, January 23.

London Institution, at 4.—On the First Principles of Biology: Prof. Huxley (Educational Course).

Royal Geographical Society, at 8.30.

Entomological Society, at 7.—Anniversary Meeting.

### *TUESDAY*, January 24.

Royal Institution, at 3.—Nutrition of Animals: Dr. Foster.

Ethnological Society, at 8.—On the Languages and Tribes of East Africa: Rev. Dr. Steere.—On African Weapons and Implements: Dr. Eyschmacher.—A Zulu Law Case: Sir John Lubbock, Bart., M.P.

### *WEDNESDAY*, January 25.

Society of Arts, at 8.—On New Paper-making Materials, and the Progress of the Paper Manufacture: P. L. Simmonds.

London Institution, at 7.—Dust and Disease: Prof. Tyndall. (Conversazione.)

Geological Society, at 8.

### *THURSDAY*, January 26.

Royal, at 8.30.

Society of Antiquaries, at 8.30.

London Institution, at 7.30.—On the Action, Nature, and Detection of Poisons: F. S. Barff.

Royal Institution, at 3.—Davy's Discoveries: Dr. Odling.

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